



FOREST PEST MANAGEMENT

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Biological Evaluation of Douglas-fir Mortality in O'Niel Creek Campground, Oak Knoll Ranger District, Klamath National Forest

Gregg DeNitto, Forest Pathologist
John Dale, Entomologist

ABSTRACT

Mortality of Douglas-fir has been occurring for several years in the O'Niel Creek Campground on the Oak Knoll Ranger District. Examination of dead and dying Douglas-firs revealed at least 5 existing black stain root disease centers. These are scattered throughout the campground in all size classes of Douglas-fir. However, the greatest impact is on the loss of overstory trees. Three management alternatives are discussed for this situation: 1) No action; 2) Remove dead and declining trees; and 3) Remove dead and declining trees and a buffer of healthy Douglas-fir. In addition, the benefits of minimizing site disturbance are discussed.

INTRODUCTION

At the request of District personnel, we visited O'Niel Creek Campground, Oak Knoll Ranger District on June 10, 1986. We were accompanied by Ruben Contreras from the District.

O'Niel Creek Campground is located along State Highway 96 near the Klamath River (T. 46N, R. 11W, Sec. 22). The site has been used for camping since the 1930's and has been a developed Forest Service site for several decades. No recent changes or management activities have been made to the 24 unit campground.

Mortality of Douglas-fir in the campground was initially observed about 3 years ago (1983). Mortality of a few trees per year has continued to occur. The objectives of our evaluation were to determine the cause(s) of the mortality and to develop management alternatives that, if implemented, would reduce pest-caused impacts.

OBSERVATIONS

The campground is in a multi-storied, mixed conifer stand. The overstory principally contains Douglas-fir and ponderosa pine. The understory includes incense-cedar, California black oak, Pacific madrone, Douglas-fir, sugar pine, Oregon white oak, ponderosa pine, and canyon live oak. Bigleaf maple and white alder are part of the understory in moist areas. The site was determined to be a site class III. Stocking at one location was 240 square feet of basal area per acre.

Dead and declining Douglas-fir were observed in the campground. Examination of the roots and lower boles of trees in five spots revealed black stain root disease, caused by Ceratocystis wageneri. This root disease is commonly involved in Douglas-fir mortality throughout the host range in California. Associated with most of the trees identified with the disease was a bluish-gray pitch streaming from the lower bole. This is an occasional symptom of infection by this root disease and can be useful in diagnosis. Sizes of trees affected by the root disease in the campground ranged from seedling to sawtimber, although most of the trees were mature. The root disease occurred primarily as single tree incidences scattered through the campground, but there were some 2 to 3 tree centers (Fig. 1). In addition to the identified infected trees, there are additional live Douglas-firs in the campground with symptoms of crown decline and basal resin flow suggestive of infection by black stain root disease. The disease was not confirmed in these trees because of the desire not to destructively sample beyond minimal basal chopping.

In addition to the root disease, a second pest was observed in some of the declining Douglas-firs. This was the flatheaded fir borer, Melanophila drummondi. This insect is primarily associated with stressed and weakened trees, such as those with root disease.

Most of the sugar pines in the campground were infected by Cronartium ribicola, the cause of blister rust. This disease is specific to 5-needle pines and is common on sugar pine in northern California. It primarily affects trees up to pole-size.

BIOLOGY OF BLACK STAIN ROOT DISEASE

Black stain root disease is caused by the fungus Ceratocystis wageneri (asexual state Verticicladiella wageneri). In California, the fungus has three host-specific strains that infect either ponderosa and Jeffrey pine, singleleaf pinyon pine, or Douglas-fir. In most situations, the fungus does not cross-over between species, even in mixed species stands.

Initiation of disease centers probably occurs when spore-carrying, cambium-feeding beetles invade tree roots and transmit the spores of the fungus to the tree. The fungus then grows in the wood of the root toward the root collar.

Once the fungus becomes established in a tree, it spreads locally between trees through rootlet contact or fungus growth through the soil for short distances and direct infection of small feeder roots. The rate of underground spread of the disease in a stand is not substantiated for Douglas-fir, although it appears to be faster than in pine, possibly 4 to 12 feet per year.

The disease can be identified in a tree by the dark brown to black stain of the wood. This stain occurs as arcs that follow the annual rings. The amount of stain present around the bole varies among trees. It may involve only a small part of the tree's circumference up to all of it. The stain may be one to many annual rings deep.

Infected trees undergo gradual to rapid crown decline prior to mortality. Symptoms of crown decline include reduced terminal growth, needle yellowing and shortening, and premature loss of foliage. Trees pole-size and larger may also bear a heavy cone crop. Bark beetles and flatheaded borers can successfully attack and kill infected trees. Douglas-firs may have grayish-blue resin streaming from the bark above the stained area.

Little information is available on stand and site characteristics associated with the disease, although in Douglas-fir it is more common along roads and in young plantations or dense natural regeneration.

MANAGEMENT ALTERNATIVES

1. No Action. This would be a continuation of the present activities of removing trees as they die. Additional mortality of Douglas-fir would occur in the areas where black stain root disease was found as long as there was the opportunity for close root proximity between healthy and infected trees. Because of the species diversity and distribution in the campground, large root disease centers (greater than 3 to 4 trees each) are not expected to develop. In areas with trees with symptoms suggestive of root disease, but where the disease was not identified, mortality may occur if the disease is present. How root disease centers in this campground are initiated is not known, so it is difficult to predict if, how many, and where additional centers may occur. The loss of some of the overstory Douglas-firs will open the canopy and let in some light, thereby possibly stimulating the growth of some of the more tolerant understory species as replacements.

2. Remove Dead and Declining Trees. Within root disease centers, dead trees and those with declining crowns and other symptoms of root disease would be removed. This may reduce the frequency of entries for tree removal into the campground, but it will have little effect on the progression of the root disease. As in Alternative #1, small openings will be created that will be occupied mainly by existing regeneration as it is released. Douglas-firs with symptoms suggestive of black stain root disease should be monitored closely for further symptom development. If symptoms of decline worsen, then the roots and butt should be examined for the presence of the typical black stain. If the disease is found, then the above prescribed actions should be taken.

3. Remove Dead and Declining Trees and a Buffer of Healthy Douglas-firs. In identified root disease centers, dead and declining trees would be removed. In addition, a buffer of surrounding healthy-appearing Douglas-firs would be removed. In general, a buffer of 75 feet beyond infected trees is recommended. Only Douglas-firs need to be removed from this area. This would reduce the need for additional entries to salvage dead trees in future years that are presently infected but still alive. It would also limit the further underground spread of the disease by limiting the availability of favorable host root tissue. Because of the species diversity and distribution in the campground, this sanitation would probably create openings of a similar size as those that would occur naturally with time. However, it would reduce the number of entries and open the stand faster. The larger initial opening beyond what would occur naturally may favor the regeneration and release of shade-intolerant species, such as ponderosa pine, in the campground. As in Alternative #2, trees with symptoms suggestive of root disease but outside of identified centers should be monitored for evidence of further decline. If black stain is eventually identified, then either Alternative 2 or 3 may be implemented in these root disease centers.

4. Minimize Additional Disturbances. During any management activities in the campground, disturbances to the vegetation and the soil should be minimized. A relationship between the occurrence of black stain root disease and site disturbance does appear to exist. Therefore, minimizing these disturbances may reduce the number of new infection centers that occur. During any harvesting activities, skidding should be minimized. This may require bucking logs to the minimum merchantable length or providing it as firewood. All vehicles should be kept on the designated roads and parking pads, both during harvesting and when the campground is used by recreationists. Any changes in the campground, such as relocating roads or campsites or changing drainage patterns, should be carefully considered prior to implementation because of the increased risk to the health of the Douglas-firs and the increased probability of infection by black stain root disease.

KEY TO FIGURE 1

- A - Recently dead Douglas-fir with Ceratocystis wageneri (Cw)
- B - 14-inch dbh Douglas-fir with Cw; died in 1985
- C - 3 large Douglas-firs with symptoms of crown decline suggestive of root disease; 1 tree with woodpecker activity in bark of lower bole; 1 tree with resin streaming from lower bole
- D - 5-inch dbh living Douglas-fir with Cw
- E - Douglas-fir stump from tree that died in 1985 and was removed; stump had evidence of Cw
- F - Large Douglas-fir with symptoms of crown decline, including stress cone crop, suggestive of root disease; heavy resin streaming on one side of lower bole
- G - Dead Douglas-fir seedling with Cw
- H - Recently felled ponderosa pine log with galleries from previous western pine beetle attacks
- I - Large Douglas-fir with only a few lower live branches; fir flatheaded borer larvae under bark; heavy bark flaking by woodpeckers
- J - Site of first Douglas-fir mortality during recent mortality event

FIGURE 1. O'NIEL CREEK CAMPGROUND

